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CONTENTS

FRONT COVER: *Whitby Harbour, by R. L. Stowell (Plastics Division)*

OUR CONTRIBUTORS

H. P. Allen *has been responsible for co-ordinating all the gibberellic acid development work undertaken by Plant Protection Ltd. From 1950 to 1956 he was in charge of weed-killer research at Fernhurst.*

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Try-out for Wonder Chemical

By H. P. Allen

Gibberellic acid, with its fantastic property of stimulus to growth, can be justly termed a wonder chemical. But to what commercial uses can these properties be put? An intensive world-wide search for markets now goes on, with success still just round the corner.

It is not often that biologists start by studying a plant disease and end up by discovering a powerful growth stimulant. This is what has happened with gibberellic acid, however.

In 1926 a Japanese pathologist, Kurosawa, noted that rice plants attacked by what is called "bakanae" or "foolish seedling" disease grew longer and more weakly than unaffected rice plants, and that they had a very pale and spindly appearance and eventually died. The causal organism of this disease is a soil-borne fungus, *Gibberella fujikuroi*, and Kurosawa discovered that when a pure culture of this fungus was spread on to rice seedlings it produced the same excessive growth characteristic as the disease.

For many years this and other Japanese studies attracted little attention outside Japan until at the beginning of the fifties, when a team of biologists (under Dr. P. W. Brian) and chemists (under Mr. J. F. Grove) at the I.C.I. Akers Research Laboratories took up the project and began further investigations. Their studies led to the isolation in 1954 of pure gibberellic acid by Mr. P. J. Curtis and Dr. B. E. Cross, and the chemists of the team have postulated a chemical structure for gibberellic acid which is now confirmed, except in minor details.

Independently of I.C.I. and a little later in time, Dr. Frank Stodola of the (then) Northern Regional Research Laboratories at Peoria, Illinois, U.S.A., began to take an interest in the gibberellins and in 1953 indicated that he had made a material containing gibberellin A_1 and "gibberellin X." Although Stodola did not know it at the time, "gibberellin X" was later found to be identical with the gibberellic acid isolated at The Frythe.

The work at The Frythe was then directed towards improving the process of manufacture of gibberellic acid, and there was developed a process which gave very much higher yields of gibberellic acid than those obtained by the Japanese or by Stodola.

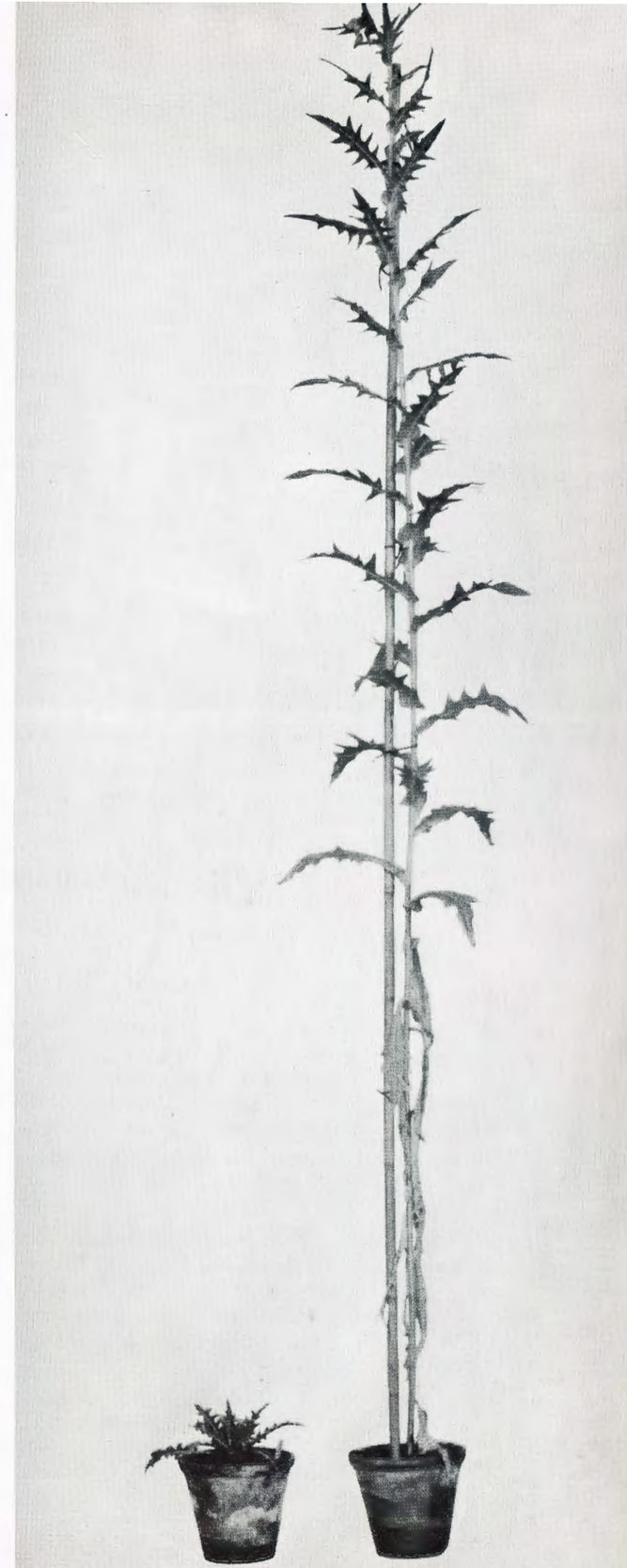
At this point patent applications were filed by I.C.I. in the United Kingdom and in several overseas countries.

From 1953 onwards the Akers Laboratories were joined in their work on gibberellic acid by Jealott's Hill Research Station, who undertook field studies with the compound, the main weight of their work being directed to an investigation of the effects of gibberellic acid on pasture grasses when used alone and in conjunction with fertilizers.

The results of Jealott's Hill's work were technically most interesting, but there were two snags. In the first place, it needed at least an *ounce* of gibberellic acid per acre to obtain a material response by way of yield increase of the grass. Secondly, although the first cut following treatment showed a substantial yield increase, subsequent cuts revealed depression, and only further application of gibberellic acid could obviate this depression. The fact remains, however, that gibberellic acid has shown itself capable of stimulating grass into growth at a time of year when temperature and day length are normally inimical to such growth.

Jealott's Hill's work ranged over quite a large number of crops, including the temperate cereals, potatoes, turnips, celery and black currants, but in no case were obvious and exciting practical possibilities opened up.

In 1955–56 Stodola distributed small quantities of his gibberellin mixture to government and commercial research workers in America and in Europe, and



Dramatic effect *of gibberellic acid on the growth of biennials is shown in this picture of treated and untreated common henbane plants. Biennials do not normally flower until after being exposed to low temperatures, but even in a warm greenhouse the treated plant shot up to 6 ft. and produced flowers.*

Ten days after treatment *with gibberellic acid, cupid sweet peas show very marked effects. The tallest plants have been dosed with a higher concentration than those in the centre, and the smallest plants are untreated.*

during the same period I.C.I. also despatched a considerable number of samples of gibberellic acid to the U.S.A. and elsewhere, so that by the end of 1956 a tremendous interest in gibberellic acid had sprung up in the United States. Most of the large U.S. antibiotic manufacturers had expressed themselves as extremely interested in exploiting gibberellic acid commercially, and they approached I.C.I. for licences to manufacture and sell the chemical.

At this stage Pharmaceuticals Division was given the task of manufacturing gibberellic acid on a works scale and Plant Protection was made responsible for the commercial development of the chemical.

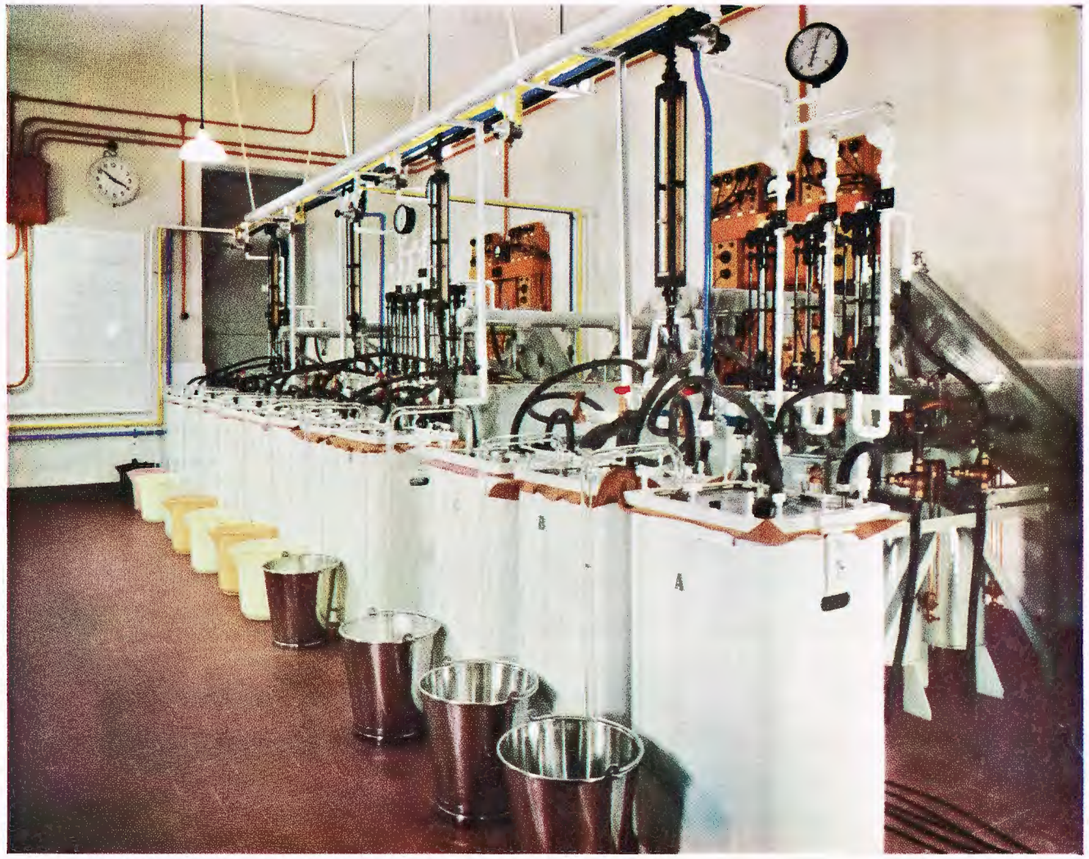
This, then, is the background; the important question is, where do we go from here?

Gibberellic acid is a most intriguing chemical. Its physiological properties are by now well known. It can bring about stem elongation; it can reverse physiological, genetic, and pathogenic dwarfism; it can accelerate flowering; and it can substitute for cold periods in the life-cycle of biennials. Gibberellic acid can also speed up germination, break the dormancy of seeds and resting buds, and is directly or indirectly responsible for a large number of remarkable responses in plants. But it is a far cry from physiological properties to practical commercial outlets, and here the position is extremely nebulous even today, when an enormous number of experiments have already been completed and many others are in progress.

If one reads both research publications and commercial publicity literature one can see that truly an enormous variety of plants and crops have been treated with gibberellic acid. In spite of this I think it is true to say that it would be impossible for anyone with his hand on his heart to write a firm recommendation for the use of gibberellic acid on any crop accompanied by a reasonable guarantee of the type of result which the grower could expect.

To date the commercial exploitation of the gibberellic acid project has been mainly in the United States and has been directed largely at the home gardener, the small-scale grower of greenhouse plants and the seedsman; mainly the first of these three categories of the public. It is impossible to say how well the chemical has been received, but I think it is safe to describe the verdict of many as being that "this is an interesting chemical but we are not quite sure what we have got out of it."

There is no doubt whatever that if this material is to find a firm place in commercial practice it must be shown capable of achieving some quite spectacular result on a major crop. For instance, it must either increase markedly the yield of the crop without impairing its quality, or it must accelerate considerably the date of maturity of the crop, or again it must cut down considerably the preliminary establishment



Preliminary investigation *of the fungus fermentation which produces gibberellic acid has been carried out in these fermenters, which were developed from domestic washing machines.*

period of long-term perennials like trees and shrubs. Has it done any of these things?

As was mentioned earlier, it can certainly induce grass to grow "out of season," but the amount required to produce this effect, namely at least an *ounce* of gibberellic acid per acre, is widely uneconomic, even assuming that gibberellic acid becomes much cheaper than it is at present. The chemical is being offered in the United States at $112 per ounce by two manufacturing companies and at $280 per ounce by others, and a very brief calculation will convince the reader that to make application worth while on grassland either the yield response would have to be fantastic or the cost would have to be only a fraction of the prices as quoted above.

However, it is probably wrong thinking to try to forecast the future of gibberellic acid on the basis of its present high cost, because if produced on a considerable scale there is no doubt that the cost of the material would reduce considerably.

At the present moment an enormous amount of research work is in progress all over the world, but particularly in the United States, on a great variety of crops, and still further work is being planned by Merck & Co. in particular. Research grants have been endowed by Merck in America, and a large-scale effort is being directed by that firm on cotton in the U.S.A. this year as a result of experiments in which, apparently, the length of the cotton fibre has been increased as a result of gibberellic acid treatment. Other fibre crops are the subject of investigation, namely flax, jute and hemp; and growers of sugar-cane in Puerto Rico and Hawaii are giving gibberellic acid a thorough testing.

(*Continued on page* 67)

Men with Ideas—1

Griffiths Jones

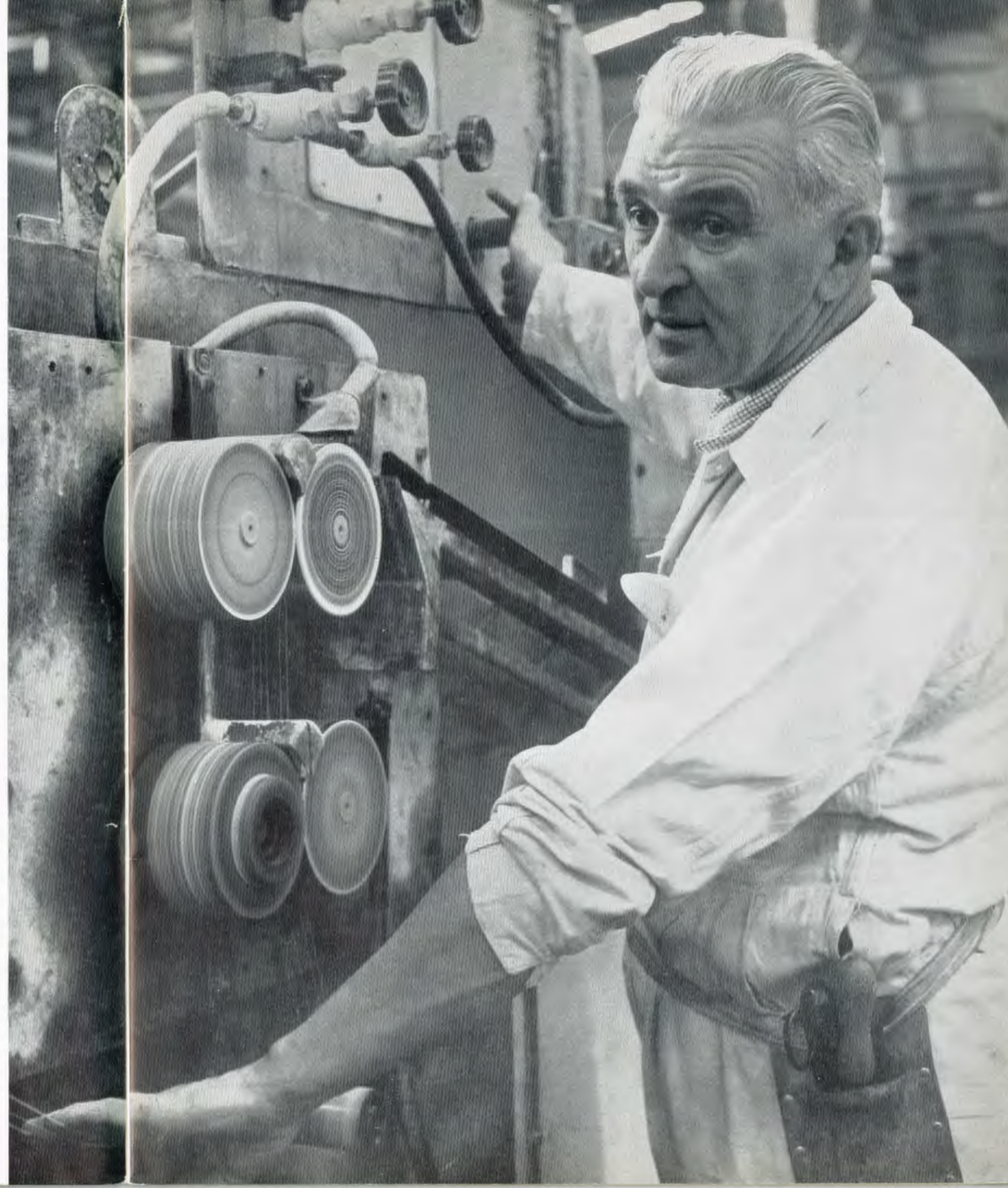
If every idea submitted under the Suggestion Scheme won £500 there would be some rich men in I.C.I. On the other hand, you don't need to be a technical genius to hit the jackpot, as Griffiths Jones can testify.

He is a process worker in Plastics Division's Hillhouse Works, where nylon chips are melted and extruded as filaments for fishing lines, surgical sutures, brushes and so on. The melting takes place in big vessels called kettles, and Griffiths Jones was annoyed by the way the outlets of these vessels became blocked up and by the means available to him for unblocking them.

He made one or two little experiments. They worked, so he roughed out his suggestion and submitted it. At first glance the suggestion did not appear a brilliant one. But when the factory management tried it out the results were unaccountably better than expected. The old trouble of blocked outlets was cured, and production of nylon monofilament increased by 25%.

Griffiths Jones' idea is mechanically simple but is still on the secret list. It involves an abstruse physical principle that not even the physicists fully understand, so that at one stroke he outwitted the scientists and won £500—the biggest award in the history of the Division.

It is the second time Griffiths Jones has made his mark in I.C.I. During wartime service at Randle Works he won the George Medal and the I.C.I. Bravery Award when he picked up a shell which was about to explode and threw it out of an assembly building, saving the lives of the people working there. (*Photos: Charles Scott*)



SCIENTIFIC DEVELOPMENTS IN 1957

By Sir Alexander Fleck, F.R.S.

When he was installed last month as President of the British Association for the Advancement of Science, Sir Alexander Fleck, Chairman of I.C.I., gave an address in which he listed the major scientific developments of 1957. In his list, which covers the world, Sir Alexander includes one I.C.I. development—the work done by Dr. Brian and Mr. Grove on gibberellic acid at the Akers Research Laboratories.

In the course of his address as President of the British Association, Sir Alexander said:

1957 is strongly associated in the minds of many followers of science with the beginning of the International Geophysical Year, and it is therefore appropriate that I should refer in my opening remarks to the geophysical events which have taken place during the last year.

The advancement of technology has probably never been so clearly demonstrated to the whole world as when the first artificial earth satellite was successfully launched from Russian soil early in October. The appearance of something which could be described as a "new moon" was a technical achievement which those on this earth with almost negligible claims to literacy could appreciate, and which captured the imagination of the British public to a remarkable extent.

Radio-astronomy in Britain

This event, closely followed by the launching of Sputnik II, dominates the I.G.Y., and is the first experiment of a type which will undoubtedly add to man's knowledge of space much that our atmosphere has prevented us from discovering before. It should not, however, detract from the other advances which have been made in the study of conditions beyond the outer confines of the atmosphere. Some of these events can at present only be assessed as technical achievements—the American manned balloon which reached a height of 20 miles, the rocket which soared to some 4000 miles, and the aluminium pellets, some of which are surmised to have been consumed by the sun.

There is one science in which the British contribution to the I.G.Y. has been of paramount importance during 1957, and that is radio-astronomy. At Jodrell Bank Professor Lovell has been obtaining the first results from the largest steerable pencil-beam type of radio-telescope in the world; its adaptability was demonstrated by the way in which it was improvised to detect echoes from the Russian satellites which it very successfully tracked. Recently it has been trained on more distant sources, and its use will undoubtedly add much to our knowledge of interstellar gas, radio stars and solar flares. In this connection a special tribute is due to the sun, whose contribution to the I.G.Y. has been a vastly great output of sunspot activity.

Nuclear and Theoretical Physics

The other notable British achievement in radio-astronomical research has been the construction of the new interferometers at Cambridge. One of these instruments is intended primarily for the study of radio stars, and another will be used to investigate continuous radiation from our galaxy. By these techniques Mr. Ryle hopes to penetrate further into the outer reaches of the universe than ever before, and thus to throw more light on one of the central controversies of cosmology, whether we live in an evolutionary or a steady-state universe.

It is probably in the field of nuclear and theoretical physics that the next most significant advances have been made. The award of the Nobel Prize for Physics to Yang and Lee has called public attention to the law of conservation of parity,* the universality of which was disproved early last year at the National Bureau of Standards in Washington and at Columbia University. Parity is concerned with the kinematics of groups of fundamental particles, and its conservation in nuclear transformations was assumed until rather more than a year ago. I merely point to the importance of constantly questioning the validity of our beliefs concerning natural phenomena, even when they have sufficient respectability to be called "laws."

*In general terms, the principle of reflection according to which nature shows no preference for left or right, physical effects being essentially the same whether viewed directly or as their reflection in a mirror.

The discovery of the 102nd element, nobelium, is another announcement made during 1957. It is the first man-made element to be discovered in Europe, and it provides another instance of international teamwork in scientific research, for British, Swedish and American scientists all participated.

The method of preparation was to bombard curium-244 with nuclei of carbon-13, which were accelerated in the 225 cm. cyclotron in Stockholm. Since the half-life of the resulting isotope was only about ten minutes, considerable ingenuity was required to identify it.

Several significant events have occurred in this country during 1957 which relate to the production of energy. The Harwell nuclear reactors known as Pluto and Neptune have both been started up, and we can expect that the latter will provide much valuable information about the design of reactors for marine propulsion.

Developments at Harwell

Of more far-reaching significance, however, is the brief announcement that Dr. Thonemann's team at Harwell have apparently succeeded in conducting a controlled thermonuclear fusion in their quartz torus known as Zeta II. This type of reaction provides the energy of a hydrogen bomb explosion, and of the sun, and if it can be made self-sustaining in the laboratory it is likely to have a major effect on power production later in this century. The energy put into the Harwell apparatus was concentrated by electric and magnetic fields so as to produce a temperature of the order of five million degrees centigrade, and it has been calculated that a ten- to twenty-fold increase would probably be required before nuclear fusion would be self-sustaining. As conducted, the experiment gave detectable quantities of neutrons, which are believed to have been formed as a result of the fusion of some of the deuterium atoms which the apparatus contained. This is a piece of pioneer work the implications of which we can now only see darkly.

In considering the production of energy I should also mention the development of chemical rocket fuels. Here the requirement is a stable material which will burn evenly to provide a large amount of energy per unit volume or weight. Of course, the military implications of advances in this field make them more the subject of speculation than of informed comment, but it has been announced that plants are being constructed in the U.S. to produce boron compounds for this purpose. The boron hydrides which, with fluorine, fulfil the requirements of a rocket fuel are thus gaining importance for reasons other than their enigmatic chemical structure, in which the boron atoms appear to be tetravalent instead of trivalent. It is a matter for conjecture whether the Sputnik rockets were powered by a fuel of this sort.

Synthetic Diamonds

Before leaving the field of inorganic chemistry I ought to allude to the production of synthetic diamonds by General Electric in America. While previous claims to have synthesised diamonds have been made, no large industrial undertaking has so successfully devoted research to the project, nor has the development of a commercial process become so far advanced as in 1957. For strategic reasons the U.S. Government has suppressed the details of the process as contained in the covering patent, but it is at least evident that very high pressures of over a million pounds per square inch are probably used in conjunction with temperatures of the order of 3000° C. The size of the resulting diamonds is small, yet some are large enough for industrial applications.

In other fields of chemistry, developments during 1957 have been mainly concerned with the continuation of long-term researches, and it would be inappropriate to single out particular discoveries from each developing subject. One such research programme is the study of nucleotides* which is proceeding at Cambridge under the direction of Sir Alexander Todd. His work has this year been honourably recognised by the award to him of the Nobel Prize for Chemistry.

I.C.I.'s Gibberellic Acid Work

Also in the biochemical field perhaps I may be forgiven for alluding to the progress which Dr. Brian and Mr. Grove and their colleagues have made during the last year within I.C.I. Theirs is one of the few British teams working on the plant growth promoting substances gibberellic acid and related compounds. These materials, hitherto only isolated from a fungus, have produced spectacular increases in the height and weight of several plants such as wheat and peas, as well as inducing premature flowering in biennials. Unpublished work in the Akers Research Laboratories has culminated in the isolation of Gibberellin A_1, a derivative of gibberellic acid, from runner bean seeds; and since the gibberellins and the auxins† have been shown to be physiologically interdependent, it now appears that there exists in plants a hormone balance such as is well known to occur in the animal kingdom. Final confirmation of the chemical structures of these new hormones will be awaited with considerable interest.

These are a few items on the line of active development, and it will be interesting to see how they progress during 1958. The list is far from being exhaustive, but it is, I believe, enough to show that our science is very much alive and that it will continue to penetrate into the daily lives of our peoples.

*Complicated chemical molecules which, linked together in long chains, constitute the nucleic acids, basic components of all living cells.

†Substances which in minute traces affect the growth of plants. Discovered in 1931.

MELBOURNE'S FIRST SKYSCRAPER

By Robin Boyd, A.R.A.I.A.

I.C.I.A.N.Z. has been one of the first companies to take advantage of the lifting of the ban imposed in Melbourne seventy years ago on buildings more than 132 ft. high. Robin Boyd, a Melbourne architect who has just returned to Australia after a year in the United States as professor of architecture at Massachusetts, regards the glass and aluminium tower built by I.C.I.A.N.Z. as a "dignified top-hat."

SEVERAL Australian cities are now talking of vertical expansion, and Melbourne is first to begin the old American practice of scraping the sky.

Until recently Melbourne was held down by an invisible net of red tape 132 ft. above the pavement. This allowed for thirteen or so storeys, but no office space was permitted by city building regulations above the limit height. Melbourne may have become the financial, and possibly the industrial, heart of the nation, but only a few of her buildings were allowed to poke their empty towers or spires beyond the barrier. Generally the skyline in the crowded downtown area was as flat as the streets below.

The amendment to the building code which has now removed the limit was made only after much soul-searching examination of the pros and cons of American skyscraping experience.

The barrier was put in the sky over seventy years ago. Melbourne at that time was bursting outwards and upwards in a boom comparable to contemporary Chicago's. Office blocks, thick with brick and plaster ornament, commonly rose to eight or ten storeys. In 1886 one rose higher than any other: the Australia Building in Elizabeth Street. It was fifteen storeys, counting a couple in the ornate slate and iron roof, it had an internal frame of custom-built iron girders and was served by new-fangled elevators driven by direct thrust from hydraulic cylinders in an elliptical pit sunk about 150 ft. into the earth below.

Melbourne at the time was only fifty years old, but they had been rich years. She was determined not to dawdle simply because of the circumstances that she was isolated from the rest of the modern world by many sailing weeks of water. Her city buildings may have contributed no leadership to architecture, but they were in the front line of the international upward movement.

Ten-storey office blocks in Melbourne's business centre in the early 1880s were contemporary with the first skyscraping enterprises in Chicago. The Australia Building came only five years after the Minneapolis architect, Leroy S. Buffington, invented the "cloud-scraping" idea, and three years before the Eiffel Tower gave shape to the contemporary vision of a new world of building technology based on the strength and freedom of the steel frame. The Australia's architect was Henry Kemp, a 28-year-old Englishman chasing the sun to Australia on doctors' orders (they told him he had two years to live, but he died in Melbourne at the age of 80).

If it had not been such a hideous building the course of Melbourne city architecture might have been different. But the Australia's aggressive redbrick ugliness combined with its size shocked the city councillors into legislating against skyscraping.

They had three motives: artistic (they wanted to retain an even skyline); health (they wanted to avoid dark shadowed streets); and efficiency (they thought it inadvisable for a city surrounded by great open spaces to crowd itself into a huddle).

The new amendment to the regulations takes care of the last two points, for it is based on a floor space index system. The taller buildings now being planned are tower or slab forms, occupying only a part of their land area and allowing more open space per person (or per car) at ground level.

Artistic or architectural grounds for objection, however, still remain. When a city skyline is fairly level, reflecting only the natural hills and plains of its streets, the architectural treatment of any tall building becomes inordinately conspicuous.

The first of Melbourne's taller new buildings, now well advanced in construction for Imperial Chemical Industries of Australia and New Zealand Ltd., is nearly twice as high as the old limit height. And it is built on the highest ground in the city. Moreover, it faces a park, which gives it the elbow room essential for effective skyscraping.

An impression *of the I.C.I.A.N.Z. skyscraper in Melbourne as it will look when completed later this year*

It will dominate the city from many angles, changing the surrounding character by its presence, almost like a cathedral in a European town, or that John Hancock building in Boston which always looks like the Empire State building thumped into the ground up to its knees.

Happily the I.C.I.A.N.Z. tower is a clean slab building of blue glass and aluminium which holds every promise of exerting a benign influence. The architects—Bates, Smart and McCutcheon—have produced as dignified a top-hat as any city could wish to wear.

On the other hand, another of the new dominating buildings half a mile away is planned to be faced richly in brick and granite somewhat in the spirit of a spring bonnet.

But this was to be expected. If there is one thing in which Melbourne architecture has excelled ever since the days of the Australia Building, it is inconsistency. Before long other investors are bound to produce competitive neighbours, a little higher, and with the architectural style equivalent of tweed caps or space helmets, and the character of the city will return to its customary variegation—but on a higher plane.

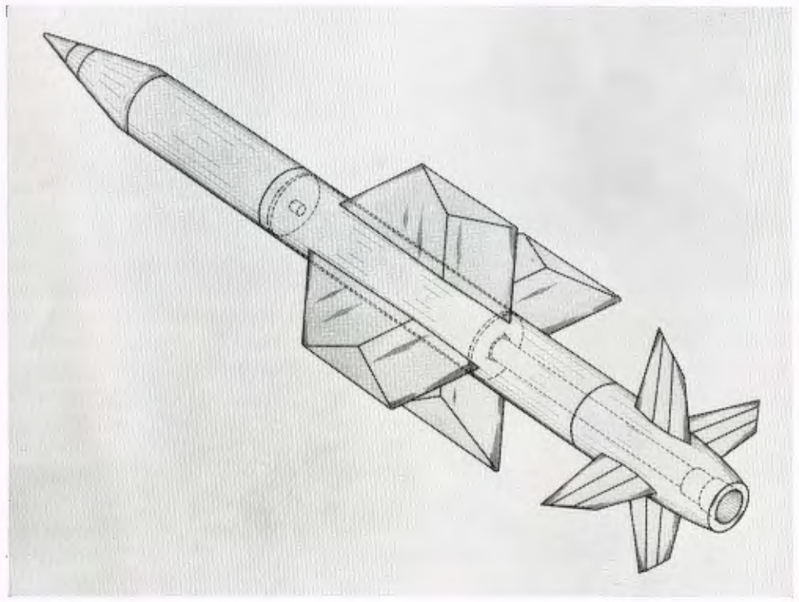
ROCKET RESEARCH

By Dr. G. P. Sillitto (Metals Division)

At Summerfield Research Station, operated by Metals Division for the Ministry of Supply, large rockets for guided weapons are being designed and tested. This explanation of the principles involved was given by the manager of the Station to Metals Division Council.

In writing about Summerfield Research Station I am reminded rather of the sultan who found himself with an hour or two to spare and decided he could spend the time with most enjoyment in his harem. The eunuchs at the gate were not really surprised to see him march in briskly, but they were surprised when he suddenly stopped just inside the entrance and scratched his head in a perplexed fashion, muttering. The eunuch nearer him told the other later that what he muttered was "I remember what I came in here to do, but I'm blowed if I know where to begin!"

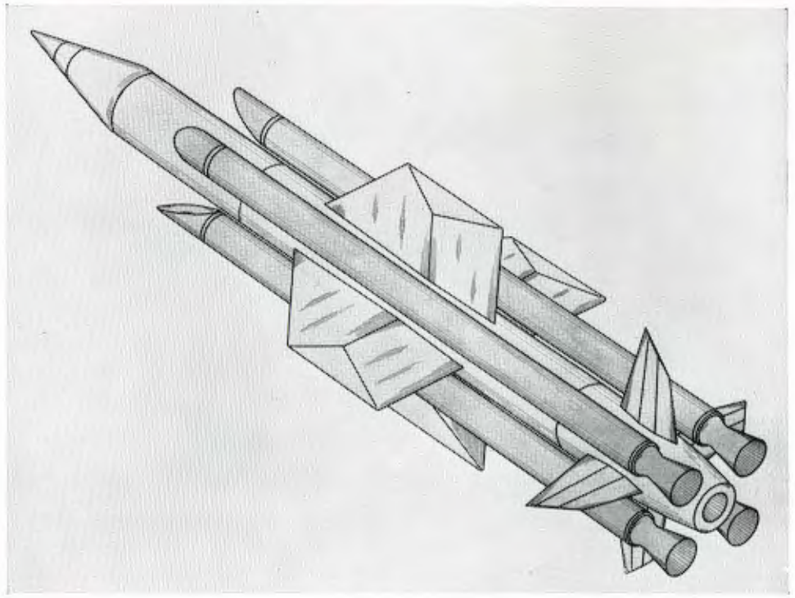
Perhaps it would be as well to begin by saying that Summerfield is near Kidderminster, and that the work we do there is not I.C.I. work at all but work for the Ministry of Supply. In fact it is a Ministry of Supply establishment, operated by I.C.I. for the Ministry of Supply. However, all the employees are employees of I.C.I. Metals Division, and so far as possible all the conditions of employment are the same as in other Metals Division works. So we have our Works Council, our Safety Committee, our Recreation Club, and so on, just as in other Metals Division works.



Outline sketch *of a typical ground-to-air guided missile (real size about 20 ft. long). The body contains electronic and hydraulic gear, a warhead, fuse and propellant.*

Our job deals with large rockets for guided weapons. We design them, and test them, and supply them to other firms which are engaged in developing guided weapons for the defence of this country. The usual thing that happens is that the Ministry tells us that it wants us to develop a rocket for a weapon which some firm is going to make. Then after discussions with the firm to determine exactly what shape, and dimensions, and thrust and time of burning, and so on they want, and when they want deliveries, we set out to try to meet the requirement.

Most people's acquaintanceship with rockets is limited to the little paper-wrapped affairs on the end of a stick which are let off on 5th November, when their happy-go-lucky behaviour does not give one much confidence that they could be seriously used as weapons. But even during the last war the V2 showed a rocket as a serious menace, and so much progress has been made since then that it is now thought that rocket-propelled guided missiles of various kinds will be the principal weapons in the future. (Indeed, you will know from your newspapers that several guided missiles are now in production in this country.) It was to help in this work that I.C.I. agreed in 1951 to assist the Ministry by designing and developing large rockets at Summerfield.



Booster rockets, *attached round the body of the missile, provide the large initial thrust. After a few seconds they drop off, leaving the main motor to sustain supersonic speed.*

Perhaps it would be as well if I try at this point to explain a bit about guided missiles, and the relation between guided missiles and rockets.

On the left is an outline sketch of a guided missile, of the kind which would be fired from land or from ships against an attacking aircraft. It is quite a big thing, perhaps 20 ft. long and $1\frac{1}{2}$ ft. in diameter, with wings and tailplanes. The wings or tailplanes can be twisted in such a way as to steer the missile; the power for doing this is hydraulic power inside the missile. The information as to which way to turn is supplied to the missile by radio methods, a large part of its inside being devoted to complicated electronic apparatus for this purpose. Inside the missile is also a warhead and its fuse, the fuse being designed to explode the warhead automatically when the missile is close enough to its target.

Finally, inside the missile is also its source of motive power, which for this kind of missile is usually a rocket of a special kind we call a sustainer rocket. It gets this name because its job is to provide just enough thrust to sustain the missile's speed at some chosen value, for half a minute or more. This speed, of course, is supersonic, well beyond the famous sound barrier.

But this sustainer rocket is only for maintaining speed. In order to launch the missile from the ground or the ship, and accelerate it up to its supersonic speed, it is provided with extra power in the form of boost rockets. In designs used in this country these are attached round the body of the missile, as in the second sketch. These boost rockets provide a very large thrust—in the kind of missile I have outlined each of the four boost rockets would give about as much power as the largest jet engines for aeroplanes. But they operate for only a few seconds and then drop off, leaving the missile to fly on under the thrust of the sustainer motor.

The research and development work we do at Summerfield covers a wide range of subjects—from mathematics to physics and metallurgy. Its general objective is to make our rockets more and more efficient, that is, to deliver more and more thrust for less and less weight, while maintaining high reliability.

One example of an original development at Summerfield is shown in our boost rocket. The tube part of it is made by winding several layers of high-tensile steel tape on a mandrel and gluing them together with special adhesives. The point about this which makes it important is that if you make a tube by welding up steel sheet, as in the sustainer rocket, the fact that it has to be welded sets a limit of say 100 tons per square inch to the strength of the steel you can use. But if you use steel tape in a way which does not need welding you can use much stronger steel—up to 140 tons per square inch, say—and so for a tube of any required strength you can use less steel and so make a lighter tube.

This is just one example of the wide range of research and development work we do at Summerfield. Alongside it all we are supplying rocket motors filled with explosive to the firms who are developing the complete guided missiles.

THE FREE PISTON ENGINE

By H. Kenney (Billingham Division)

The free piston engine is essentially a diesel engine with a difference—the difference being that it has no crankshaft, bearings or flywheel. Its simplicity and the fact that it will run with high efficiency on low-grade fuels such as peanut oil make it an attractive new source of power.

IN keeping up with new scientific and technical terminology these days the great truth of the Red Queen's remark to Alice becomes apparent, for indeed "It takes all the running you can do to keep in the same place." And here is another one—the free piston engine. What is it, how does it work, and why should I.C.I. buy some?

A free piston engine consists of a gas generator to make gas and a gas turbine to use it, very much as a steam boiler makes steam and the steam turbine uses it. How does the gas generator make gas? Simply by burning oil, in what is essentially a diesel engine with a difference. The difference is that the gas generator, unlike a diesel engine, has no crankshaft, bearings or flywheel. It has pistons; but they are not tied to a crankshaft via connecting rods, and to this extent they are free—hence the name "free piston" engine.

This absence of crankshaft and bearings is not only an important simplification but it enables the burning of the oil fuel to take place at high pressure, which leads to high combustion efficiencies with almost any kind of liquid fuel. General Motors have run gas generators on peanut oil, paraffin and cheap boiler fuel oil.

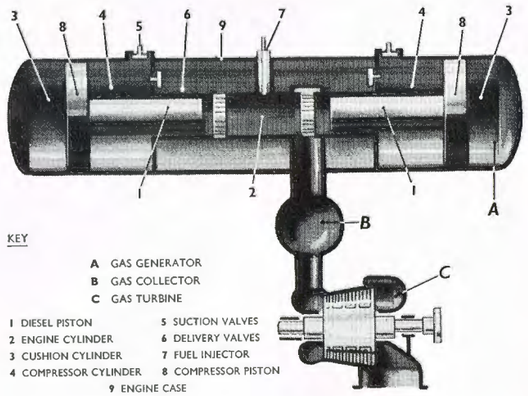
Now, when a diesel engine burns the right sort of fuel oil, it does it very efficiently. But the gas generator part of a free piston engine is even more efficient than a diesel. However, by the time the hot gas from the generator has gone along the pipes to the gas turbine and through the turbine, some of the power is lost and the overall efficiency falls to a figure about 3% less than a good diesel engine. But what the free piston engine loses on the swing of efficiency it more than makes up on the roundabout of being able to burn low-cost oil fuel, so that the fuel cost for each horsepower of useful work done is less than with a diesel engine.

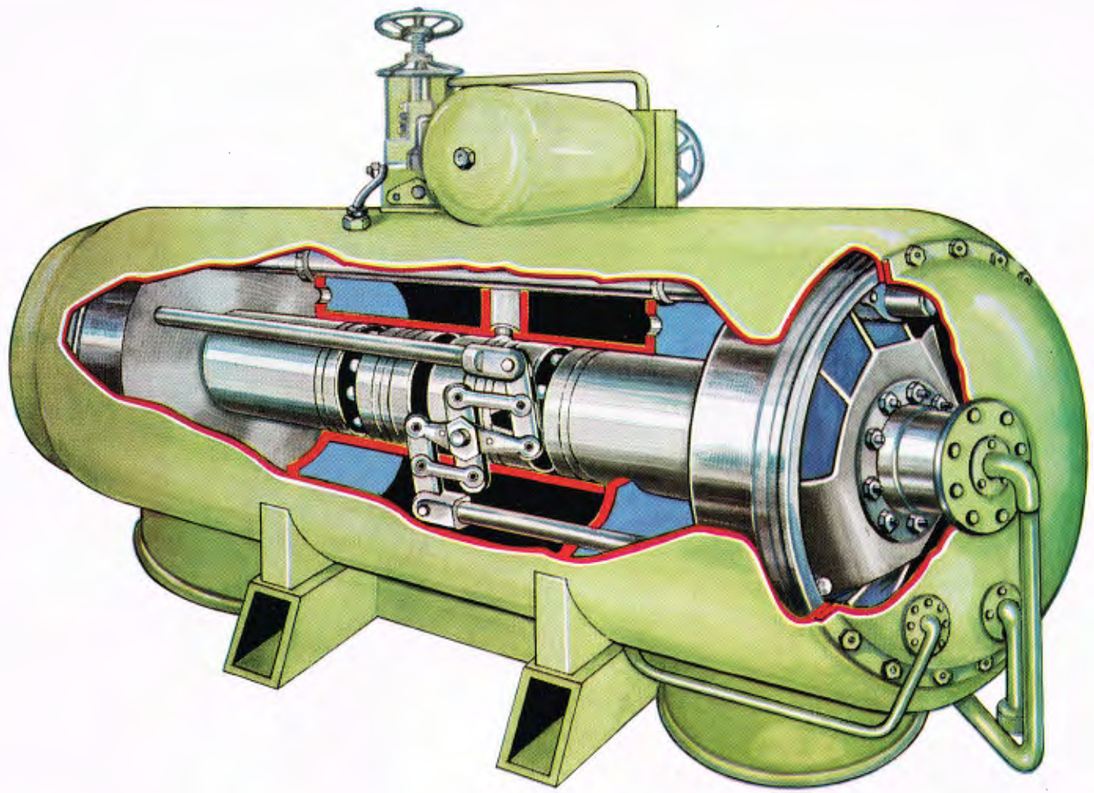
There are several different forms of gas generator, and the principle described here is the one which is most widely used. It was invented by an Italian, the Marquis de Pescara, in the early 1930s, and much of the fundamental development work was done in Switzerland. Later the French took it up, one of the reasons probably being that in France, unlike this country, there was no large, efficient, and well-established diesel engine industry.

Shortly before the war the firm of Alan Muntz became the main licensees in this country, and in the last two years several British firms have taken out licences to manufacture gas generators. There are two sizes of gas generator being made at present, a large one of 1250 h.p., of French design; and a small one of about one-third the power, of British design.

To get a lot of hot gas from the oil that is burned in the heart of the engine, and get it at the right pressure and temperature, it is necessary to mix a fine spray of oil with a lot of air and to use a compressor to provide this air, "supercharging" as it is called. In the Pescara design the compressor pistons provide the compressed air first to the engine case and then to the engine cylinder. This design is known as an "inward compressing type" to distinguish it from the "outward compressing type" which other manufacturers are developing, mainly in the United States. The cycle of operations is as follows.

Let us assume (see diagram) that the pistons 1 and 8 have moved inwards from both ends so that the space 2 has been reduced in volume and both the pressure and temperature in 2 have consequently been increased. Oil is now squirted in through 7. The temperature in 2 is high enough to make





the oil burn without any sparking plugs such as you have in a motor car, and the pressure and temperature in 2 rise still further and the pistons 1 and 8 are forced outwards.

This compresses the air in the cushion or bounce cylinders 3, and at the same time a fresh charge of air is drawn in through the valves 5 into the compressor cylinders 4. As the pistons move outwards they uncover slots or ports in the wall of the engine cylinder 2, those on the left being called scavenge ports and those on the right being called exhaust ports. The piston on the right uncovers the exhaust ports before the piston on the left uncovers the scavenge ports. The hot combustion gases start to rush out through the exhaust ports into the gas collector B and so to the gas turbine C. Then the scavenge ports are uncovered, and the air which was stored in the engine case 9 from the previous inward stroke of the compressor pistons 8 rushes in the scavenge ports, sweeps out or scavenges the remainder of the combustion products in the engine cylinder 2 from end to end, and provides some nice clean, supercharged air to help to burn the next lot of oil when it is squirted in.

All the hot gases and scavenge air collected in B pass to the gas turbine C and make it spin round so that it can be used to drive a machine. The mixture of hot gases and scavenge air when it arrives at the gas turbine is not so hot that special steels have to be used for the turbine, and so the turbine is likely to have a long life and require little maintenance. The pistons continue to move outwards until the compressor pistons 8 have compressed the air in the cushion cylinders 3 to such an extent that there is enough energy in the cushion air to bounce them back inwards again. The air that was drawn in through the valves 5 is now forced into the engine case 9 through the valves 6. It stays there waiting for the ports to be uncovered so as to do the job of scavenging and exhausting which we have already described.

In fact we are back where we started, having done the round trip. Alice might have asked "Yes; but how did you start?" and so will probably the reader of this article. Well, clearly the engine will not start itself any more than a motor car, so we have a self-starter. This is not the usual electric motor but a device which forces high-pressure air suddenly into the cushion cylinders and makes the pistons move rapidly inwards. When they reach a certain point, oil fuel is squirted in and the engine starts.

In the plant which I.C.I. is designing there will be fifteen large gas generators in all, supplying hot gas into a distributing system from which a number of gas turbines are fed. These gas turbines will drive rotary machines for which they are well suited, because the speed of the turbine is about the same as the speed of the machine it is driving, so that no intermediate gearing is necessary. This is just one of the reasons why the engine was adopted by I.C.I.

Its capital cost is reasonable, and we think its cost of maintenance will not be as high as the engines which were used before on other similar plants. There are problems to overcome, of course, and the installation will be the first large industrial plant in the world; but nothing venture nothing win, unless you feel like Alice: "I'd rather not try, please . . . I'm quite content to stay here."

New Roses

By Philip Harvey

An accusation commonly levelled against professional rose-growers is that they produce too many new varieties, none of them smelling as sweet as the old roses. Philip Harvey here explains how rose trials are organised and defends the new varieties, stressing their superiority over the roses of pre-war days.

ANYONE who is in the least degree interested in rose growing must have wondered whether the new varieties which so often arrive with a fanfare of trumpets (especially those from Europe and the U.S.A.) are really better than the old-timers. Obviously there is a much wider colour range, with numerous bi-colours and multi-colours which are sometimes eye-catching rather than restful; but do the modern roses enjoy the same vigour and constitution as their predecessors? Again, are not the majority of varieties scentless or nearly so? Finally, what on earth is the need for so many new roses every year when relatively few show any marked improvement over older varieties?

Moderns are Better

These are perfectly reasonable questions, but they cannot be answered in two or three sentences. I must, however, make it quite clear at the outset that in my experience the moderns are (with, of course, some exceptions) considerably better in every respect than their predecessors. In recent years science has come to the aid of rose hybridisers, who are now working on more progressive lines and rejecting many seedlings that twenty years ago would have come on the market. Now they are consigned to the bonfire!

Decline of Old Varieties

Rose *varieties*, in common with many other plants propagated vegetatively, i.e. by budding, cuttings or any method other than seed, deteriorate after a number of years, when a particular variety is said to have had its day. As all the trees of a variety belong to a single clone (this term refers to all plants produced vegetatively from one original plant), deterioration will be general, irrespective of the area where the variety is grown. Why this should happen is by no means clear. Certainly it does not usually occur where a rose or other plant is a pure species or maybe a first or second cross therefrom. But for all practical purposes it means that a regular supply of new introductions is necessary to replace those which fall by the wayside. Deterioration may set in twenty, thirty or forty years after the date of introduction (sometimes even longer), but it cannot be postponed indefinitely and appears inevitable with all those varieties with a complicated ancestry.

Trial Ground Certificates

In England the National Rose Society is making a very successful attempt to raise the general standard of new roses. Every year hybridists from all over the world send new seedlings to the Society's Trial Ground near St. Albans in Hertfordshire, and these are judged under six headings: growth (vigour, habit and foliage); freedom from disease; beauty of form or formation of trees and colour; freedom of flowering; general effect; fragrance. Twenty points are given for the first four headings and ten each for the last two. To obtain a Trial Ground Certificate a variety must secure a total of 70 points and not less than half marks under the first four headings, thereby ensuring that any one outstanding characteristic cannot unduly influence the final result.

Nursery catalogues usually state which of the varieties they offer have secured a certificate, and one can be confident that any of the successful candidates will do reasonably well in most gardens, as they receive

Perfecta, *an outstanding new hybrid, of great vigour and with fine big blooms*

no "coddling" at the Trial Ground. Sometimes a particular rose which fails to make the grade at St. Albans subsequently does very well in gardens, simply because some varieties have their likes and dislikes regarding soil or district. An instance is the red and yellow Tzigane, one of the finest present-day bi-colours. For some reason this was not at its best at the Trial Ground.

To secure a gold medal a variety must first obtain the Trial Ground Certificate, at the same time showing some new or outstanding quality, for example a new shade of red, or supersede a similar variety which has deteriorated in constitution.

Vigour of New Hybrids

All very well, you say; but how many gold medals are awarded in relation to the wealth of novelties offered? Admittedly very few; but the standard is extremely high, and in any case most of the newer roses, whether Trial Ground winners or not, are definitely ahead of pre-1939 introductions. To begin with, they are usually much more vigorous with excellent constitutions. Typical instances in the hybrid teas are Eden Rose, Fred Howard, Grand'mère Jenny, Margaret, Peace, Perfecta, Sutter's Gold and Tallyho. Many will also give large specimen blooms for exhibition and in reasonable quantities. In the 'thirties exhibition varieties were often lacking in vigour and not sufficiently free-flowering for garden display, the reason being that some hybridisers had tended to put size of individual bloom before vigour and general garden qualities.

There is still some misunderstanding among non-exhibitors about showing roses. The exhibitor's skill lies in having blooms in the pink of condition at the precise moment the judges walk round. To achieve this he must grow a number of trees of a few varieties, not an assortment of many different kinds, otherwise he will never, save by chance, obtain specimen blooms on the day they are required. From time to time most gardeners obtain blooms just as good as those seen at the shows, but careful timing as regards pruning and feeding is the key to prizewinning roses.

Brilliant Floribundas

Progress in developing new colours, or variations of existing shades, really justifies that overworked adjective "remarkable." This applies to both hybrid teas and the cluster-flowered roses or floribundas (formerly called hybrid polyanthas). In the hybrid teas, the brilliant colour contrasts of red and yellow as seen in Cleopatra, Gay Crusader, Sultane and Tzigane must be mentioned. Admittedly red and yellow bi-colours existed before 1939, but they were usually poorly shaped. In floribundas there are numerous scarlets of a brilliancy quite unknown in pre-war days. Atom-bombe, Concerto, Elsinore, Korona, Orange Sweetheart and Sea of Fire are typical. The beautiful salmon shades of Fashion (unfortunately very liable to rust in some areas) and Spartan are also new. The latest floribundas are exceptionally free-flowering and are even hardier in a very severe winter than many of the hybrid teas.

Disease Resistance

We must not overlook the debit side. Although the moderns mostly surpass their predecessors, there are several weaknesses which need prolonged investigation. Too many varieties have soft petals which dislike wet weather. Others open quickly in hot weather or do not keep their colour. Disease resistance can be an acute problem in country districts where black spot is widespread, especially in wet summers. Some of the latest floribundas, notably Yellowhammer and Jiminy Cricket, are markedly resistant, but many demand regular spraying with a thiram or captan fungicide.

Fragrance is not, in my opinion, the problem some misguided enthusiasts would have one believe. The first essential surely is to have a rose which grows well and blooms freely without special attention. If in addition it is fragrant, so much the better; but a weak-growing, shy-flowering variety with a strong perfume is not wanted. However, many of the moderns like Sutter's Gold, Chrysler Imperial and Panorama are just as fragrant as the old-timers and there is a greater variation in perfume, some varieties like Marcelle Gret and Eddie's Cream even smelling of apricots.

Temperamental Old-timer

Let me finish with two indispensables. The most brilliant of all the old-timers is Austrian Copper, difficult to propagate, as temperamental as a prima donna, preferring pure country air and highly susceptible to black spot. By contrast Perfecta, the latest German hybrid tea only released last autumn, produces quantities of exhibition blooms, which last a week when cut, on a plant of outstanding vigour.

Austrian Copper, *one of the most brilliant of the old-timers*

Kaieteur Falls

By W. de M. Clarke

Five times higher than Niagara, the Kaieteur Falls in British Guiana are one of the wonders of the world. But few people have heard of them, and fewer still have been lucky enough to see them.

Photograph by John Durey

WHO has heard of the Kaieteur Falls? I don't suppose one reader in ten thousand. Yet they are the second highest falls in the world —second only to the Angel Falls in Venezuela and five times higher than the Niagara Falls. Few people have seen them. To reach them overland takes nearly seven days of arduous trekking—by river, by road and by bush trail.

Our route to the Falls was by air, and we were the guests of a prominent British Guiana businessman. At 10 o'clock one January morning in 1957 ten of us embarked at Georgetown in a Grumman Goose Amphibian plane with a picnic lunch and tea.

First we set course for the Essequibo River. Then we followed the Mazaruni River, with nothing but dense forest on either side except for an occasional clearing where greenheart and other timbers were being handled. The river then turned westward, and we left it flying over the nearby impenetrable rain forest. Eventually hills appeared in the distance, and finally we arrived over the Potaro River just where it emerges from a deep gorge.

Suddenly, at a sharp turn of the gorge, we saw the Kaieteur Falls. They were a majestic sight. The water fell over a vertical 741 ft. drop (the largest single drop in the world) into a huge rocky amphitheatre and then fell another 80 ft. in a series of rapids below the falls.

Every second 10,000 tons of water *cascade from the top of the falls into a deep gorge. On a rocky ledge Harry Wendt, pilot of the amphibian, talks to Mrs. Mary Durey and the author's wife.*

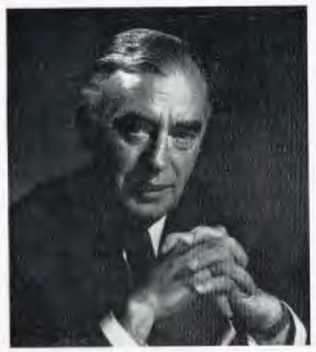
Harry Wendt, our pilot, an American recently awarded the honorary O.B.E., took the plane up the river and brought her down between the falls and some rapids two miles upstream. We taxied to a small forest clearing on the left bank, where a few people were working. The plane was moored, making use of trees as bollards, and a rough plank was run over to the cabin door. Off we made down a forest trail, taking our cameras and picnic lunch. After a mile we emerged on to a large rocky ledge at the edge of the falls. They were magnificent.

Over a stretch 150 yards wide (in the rainy season 400 yards), some 10,000 tons of water were pounding down every second into a deep gorge below. But so high were we above the floor of the gorge that the roar of the falls was stilled. It was an uncanny, almost silent, sliding of great waters into a deep abyss carved out from the rock by centuries of attrition.

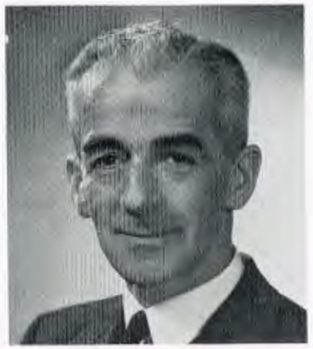
By following narrow forest paths round the amphitheatre we were able to view the falls from different angles. During one trek we saw that rare and handsome bird the "Cock of the Rock." Even the members of the Royal Zoological Society who had recently spent six months in British Guiana had only once seen one, and then only for a very few seconds.

When the time came to leave, Wendt taxied up-river, turned, and put the engines to full speed and made his take-off down-river towards the falls. We all prayed that nothing would happen to the engines as we neared the brink. We crossed the falls about 20 ft. up and gasped as we looked down on to the chasm below, so remote, so very desolate.

NEWS IN PICTURES

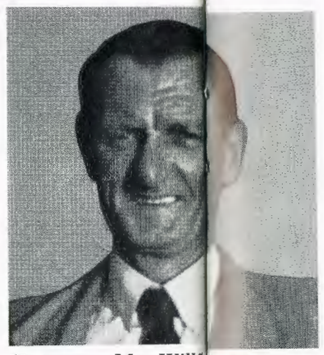


Knighthood. *Mr. W. J. Worboys, I.C.I. Commercial Director since 1948 and chairman of the Council of Industrial Design since 1953, received a Knighthood in the New Year Honours List*



O.B.E. *Mr. S. Alty, Works Manager of Alkali Division's Brine and Water Works since 1951, received the O.B.E. in the New Year Honours List*

Castner Medal. *I.C.I. Deputy Chairman Dr. Ronald Holroyd has been awarded the Castner Gold Medal of the Society of Chemical Industry for 1958*



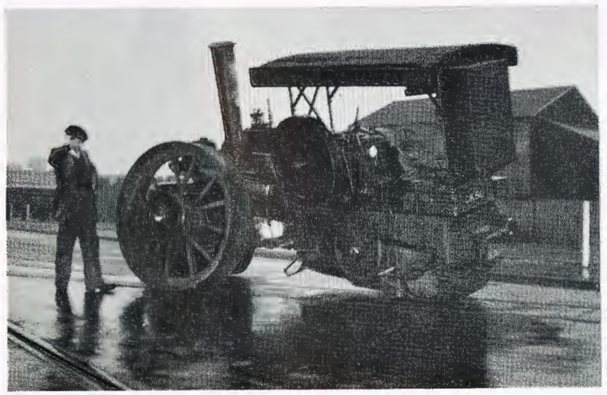
50 years. *Mr. Willi... of the vehicle departm... ton Excelsior Works ... pleted 50 years' servic... the Company in 1907 ... the tool ro...*

...am Hitchcott ...ent at Marston recently com... e. He joined ...s shop boy in ...om

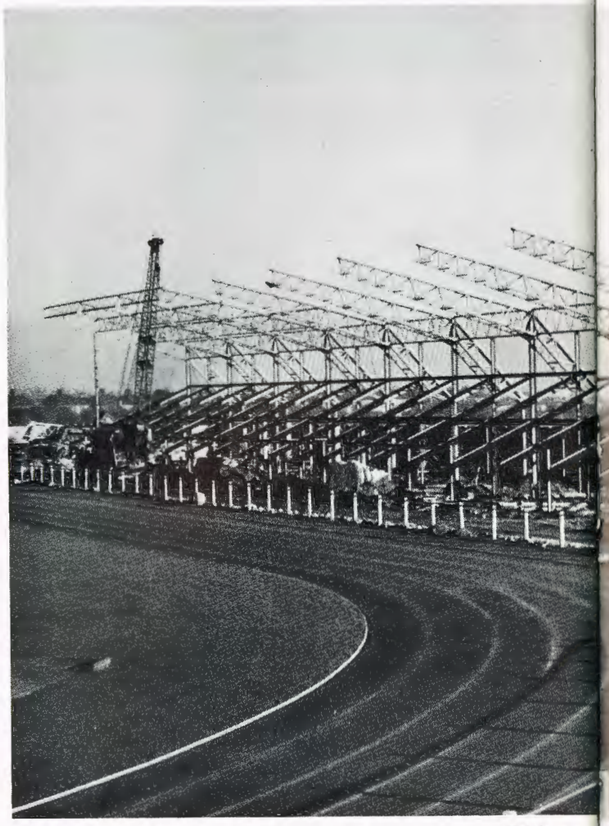
Bravery award. *Maryhill Factory apprentice Ian Halliday has been awarded the Boys Brigade cross for his attempted rescue of a drowning boy at a Brigade camp at Dunbar last summer*

New apprentice school—1. *A plaque commemorating the formal opening of Billingham Division's new apprentice school was unveiled by Sir Edward Boyle, Parliamentary Secretary to the Minister of Education, when he visited Billingham just before Christmas. In this picture he is seen with Mr. J. A. L. Young, Division Personnel Director*

Gold medal cooks. *Cooks at Regent Works, Linlithgow, won a gold medal and trophy for their entry at the recent Salon Culinaire at Falkirk. Above: Miss G. Barr (canteen manageress) receives the trophy*



Aground. *Kynoch Works 43-year-old steamroller went aground when her back axle let her down recently. No wonder driver Fitzpatrick looks perplexed!*



Sports stadium. *Work is going ahead on the stand at the Billingham ... run along one full side of the 440-yard running track and will incorpo...*

Synthonia Club's new sports stadium. The stand will ...ate offices and dressing rooms for players and officials

New apprentice school
television to three screens in ... a group

—2. The unveiling ceremony was relayed over closed circuit ... the apprentice school workshop bays. Our picture shows ... of apprentices around one of the sets

New President of B.A. *Sir Alexander Fleck was installed as President of the British Association for* 1958 *at a ceremony in London. In his inaugural address he reviewed last year's scientific developments, and announced plans for science lectures to general audiences in simple terms. Part of his address appears on pp.* 44–45

Silent salesmen. *Soon*
emphasises the
to be seen in the Divisions is this exhibition of I.C.I. and other packages, which importance of good appearance in bulk as well as retail packages

Home trail. *Mr. E. Holmes, draughtsman at Billingham and a keen runner, believes in killing two birds with one stone—he not only gets himself home from work* (9 *miles*) *but puts in a practice run as well*

Steatite Club's birthday. *The Recreation Club of Steatite and Porcelain Ltd., with* 1000 *members, celebrates its* 21*st birthday on* 18*th February. The picture shows the clubhouse at Stourport, converted from an old farm. Since the photograph was taken the barn has been removed and extensions built to the house*

At the circus. *A quick make-up lesson from Noe Noe for some of the* 140 *children from the Northwich district who visited the circus at Manchester under the auspices of Alkali Division's Children of the Unemployed Fund*

Goal-shooter. *Miss Dorothy Tonge of Dyestuffs Division Supply Department has been playing as goal-shooter for the Lancashire County junior netball team. She is* 17

A patrol car *manned by two ex-police officers is now in operation at Wilton as part of the drive to cut down on road accidents on the site.* (*See p.* 67)

PICTURES FROM OVERSEAS

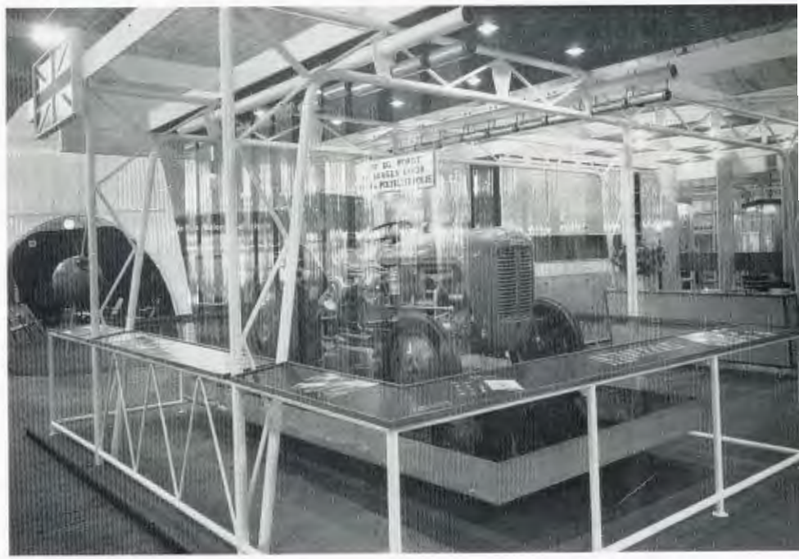
Pakistan. *Mr. W. E. Wilkie-Brown, chairman of I.C.I. (Pakistan), received the C.B.E. in the New Year Honours List for services to the U.K. community in Pakistan*

Australia. *To cope with a rush order from Tasmania for 'Trithion' and to ensure that the miticide coincided with the mites a special aircraft was chartered by I.C.I.A.N.Z. to get supplies there on time. Below: A member of the I.C.I.A.N.Z. Hobart staff examining the 'Trithion' consignment*

New Zealand. *The headland in the picture looking like a boot to match the toe of Italy is Point Koherurahi, site for a future I.C.I.(N.Z.) explosives magazine with a planned storage of 600 tons. It is estimated that 600 tons of explosives and two million feet of 'Cordtex' fuse will be used for the giant Benmore dam, the first of New Zealand's eight projected hydro-electric stations*

Belgium. *"Before" and "after" photographs of I. was successively a flour mill, a sugar factory and a over to offices, a library, dyestuffs and water treatment*

C.I. Belgium's new Brussels office. The building, erected in 1912, paint works before I.C.I. bought it. The top two floors are given laboratories, and a staff canteen, the remainder to warehousing



Holland. *A striking exhibit at the recent International Plastics Fair at Amsterdam was a Ferguson tractor suspended on 'Melinex' film strips 0·002 in. thick. 'Melinex' polyester film is at present being made in pilot plant quantities at Welwyn*

Southern Rhodesia. *The Governor of S. Rhodesia, Sir Peverell William-Powlett (centre), inspects A.E. & C.I.'s new £3,500,000 fertilizer plant at Rodia near Salisbury. With him is Mr. K. W. Spilhaus (facing camera), managing director of A.E. & C.I. (Rhodesia). When completed, plant will cover over 25 acres*

People and events . . .

Lord Waverley (formerly Sir John Anderson), who died on 4th January at the age of 75, had been a non-executive director of I.C.I. for 10½ years. He was first appointed to the I.C.I. Board in May 1938, but resigned in November of that year on his appointment as Lord Privy Seal. He rejoined the Board on 1st January 1948.

He had been ill for some months, but during a short recession of his illness he insisted on fulfilling a long-standing promise to open the new Pharmaceuticals Division Laboratories at Alderley Park, and he was able to attend a board meeting in November at which the members expressed their pleasure at seeing him again. Unfortunately the promise of renewed health was not fulfilled, and he had to return to hospital.

During his last illness he was invested on behalf of Her Majesty the Queen with the Order of Merit.

Sir Alexander Fleck writes :

Lord Waverley's greatest contribution to our generation has, of course, been in the realm of public service, and many have spoken with experience on that aspect of his work. It has, however, been my privilege during recent years to be associated with him in a type of work where his contributions are perhaps less well known. As a non-executive member of the I.C.I. Board his very great experience of public administration no less than the wealth of his learning have been of immense value to us in the decisions we have had to make.

If a matter was to be discussed informally he was always willing to come round for an exploratory talk, and his comments were understanding and helpful. In formal discussion his questions were incisive and his conclusions expressed shrewdly, logically, and commendably briefly.

There were three aspects of affairs that would arouse his particular interest: finance, personnel and technical. On technical matters his concern increased as the point veered to the scientific as distinct from the technological.

When matters concerning the conditions of individuals or of classes of staff had to be decided, he approached the question in a practical, down-to-earth way. The business of industry, like Her Majesty's Government, had to be kept working, and if a compromise were required then it had his support, with a plea, maybe, that some one or other point of importance should not be put in jeopardy.

* * *

I would not give the impression that in his wealth of knowledge he was a man remote from personal relationships. On the contrary, many readers will remember his obvious enjoyment when he joined our dinner and entertainment after the Central Council Meeting in London less than a year ago, and how he would slip in to watch the first aid competitions if he happened to be at Imperial Chemical House for a board meeting. Not very long ago he travelled to Ardeer to distribute long service awards.

To us who had the privilege to work with him in developing business policies and who will now be conscious of how great will be our loss, he will be remembered as a wise, experienced counsellor and as a considerate and understanding friend.

The First Dynamite

EIGHTY-FIVE years ago (on 13th January 1873, to be precise) **Alfred Nobel** and his construction engineer, **P. A. Liedbeck,** prepared the first nitroglycerine charge at Ardeer Factory.

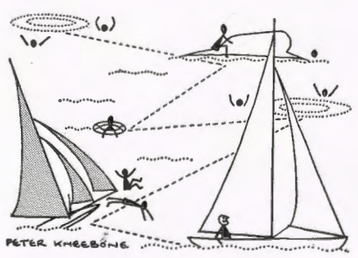
This batch of 1500 lb. was the first to be made in Britain, and on the next day an advertisement appeared in the *Mining Journal* announcing: "The British Dynamite Co. Ltd., having erected extensive works at Ardeer, Ayrshire, near Glasgow, with all Mr. Nobel's recent improvements for the manufacture of Dynamite, are now prepared to execute orders for Home Consumption and for Export." Dynamite is nitroglycerine incorporated with an inert filler which makes it safe to handle, and had been patented by Alfred Nobel some years before.

The factory at that time consisted of offices and process buildings dispersed over 100 acres and surrounded by a palisade. There were 36 men, 3 boys and 8 girls employed on the process, and they walked to work along unlit tracks in the sand dunes.

A View to Leeward

I.C.I.'s 'Melinex,' the "tough guy" of the plastic film world, made a surprise appearance at the boat show last month.

On the Austin Farrar stand the tough, transparent polyester film was shown made up into sails for a catamaran.



Apart from the obvious virtue of transparency, which enables the helmsman to see to leeward, other advantages are claimed for 'Melinex' sails, such as lightness and the ability to shed water.

At the moment 'Melinex' sails have drawbacks and are little more than an interesting curiosity. There are difficulties in making them up which will have to be overcome if the idea is to catch on. But as the *Observer* yachting correspondent wrote: "If marine insurance companies have ever worked out how many collisions are caused by not being able to see through an ordinary jib, they must surely like the look of this development."

TV in the Works

WHEN **Sir Edward Boyle,** Parliamentary Secretary to the Ministry of Education, opened Billingham's new apprentice school recently, closed circuit television enabled 150 factory apprentices in the main workshop to see and hear him.

On three receivers installed in the workshop the boys saw **Mr. W. J. V. Ward,** the Division chairman, and Sir Edward make their speeches and saw Sir Edward unveil the plaque—a ceremony they would otherwise have missed.

This is not the first time that television has been used at Billingham. In 1956 more than 130 ten-minute live transmissions were made from the factory to the I.C.I. stand at a Middlesbrough productivity exhibition. Visitors to the stand were able to see and hear interviews with employees and on-the-spot descriptions of work in progress. A film of the royal visit to Wilton Works was made and transmitted to the stand within three hours of the event.

Alkali Division used closed circuit television to stimulate interest in a safety week at Wallerscote Works. From a temporary studio in a warehouse three programmes a day were sent by land-lines to eleven receivers scattered throughout the works.

Danger—Man at Work

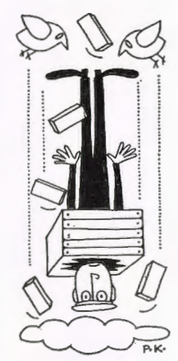
ONE of H.M. Building Inspectors has on his files this report by a builder's labourer on an accident:

"A building was being demolished and I had to take bricks down to ground level about forty feet below the scaffold platform. There was a pulley attached to the upright supporting the platform, and passing over this pulley was a long strong rope extending down to ground level.

"I found a large box on the platform and filled it with bricks. I passed some lengths of wire through holes in the sides of the box and twisted them on to the end of the rope.

"I then went down to ground level. I pulled on the end of the rope and swung the loaded box clear of the platform.

"It was very heavy and I was pulled upwards. When I was going up, bricks fell on me because the box was swinging and throwing the bricks out. As I passed the swinging box it struck me, severely bruising my head. When I reached the top, my fingers became jammed between the rope and the pulley, and this was sore. At the same time the box struck the ground and part of it broke, causing some of the bricks to fall out on to the ground.



"The load was now lighter, so the box went up and I started to come down. Some of the long nails of the broken box scratched my leg as I went past the box. I landed heavily and twisted my ankle badly on some of the bricks which had fallen out of the box. This caused me to release my hold on the rope. The box, with the rest of the bricks in it, came down quickly and hurt my shoulder. That is all I know about the accident."

"Possible" for Empire Games

John Metcalf, a Billingham Division labour officer and a member of the Synthonia Athletic Section, has been named by the Amateur Athletic Association as a "possible" for England's Empire Games team at Cardiff next summer. He is listed as a possible competitor in the 440 yards hurdles.

Mr. Metcalf, who joined Billingham Division a few months ago, was in the England team which met Poland in an international athletics match in September sprinting and hurdles events; but he is primarily a hurdler, and it was in these events that he represented Great Britain and England in matches against France and Germany, as well as Poland.

He is a member of the Achilles Club and has run for the A.A.A. against Wales, Combined Universities and United Services.

Steatite Majority

A 21ST birthday is ample excuse for a celebration, most people think. The members of the recreation club at Steatite and Porcelain Products Ltd., the Metals Division subsidiary at Stourport, are no exception. Their club achieves its majority on 18th February, but festivities will go on for the whole of this year.

There are 1000 members, and every one of them and their families will be able to take part. Many of the children are already looking forward to a Guy Fawkes bonfire and barbecue, gardening and handicraft enthusiasts are planning their entries for the horticultural show and homecrafts exhibition, and the "not-so-youngs" are going into strict training for a veterans' walk.

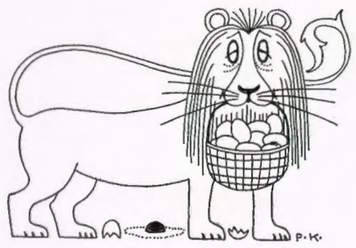
The clubhouse is an old converted farmhouse in Bewdley Road, Stourport, with playing fields and tennis courts attached. For some years the works Labour Officer, **Mr. George Slater,** acted as secretary. When expansion of the club made this a full-time job it was taken over by cheerful, diplomatic **Mr. Leslie Way,** who takes part himself in nearly every social and sporting occasion. The club steward, **Mr. Arthur Nevitt,** presides over the bars at the clubhouse, and his wife also helps in the club.

Look for the Lion

WHETHER they derived their inspiration direct from the I.C.I. tie is not known, but several big American

chemical companies such as du Pont, Olin Mathieson, and Rohm and Haas now sport company ties. Reporting this, the American journal *Soap and Chemical Specialties* comments: "Sort of a screwy idea, but it seems to be spreading."

Just how screwy the idea is can be judged from the experience of an 'Alfloc' representative. Resplendent



in his I.C.I. tie, he approached the enquiry desk at a factory and said "May I see Mr. Blank, please?"

The girl behind the desk looked at him for a moment and then, spotting the tie, broke into a smile and said: "Oh, I know what you want. You're from the Egg Marketing Board, aren't you?"

First Indian Chairman

A REMARKABLE series of "firsts" will be completed by **Mr. Jag Mohan Lall** on 1st April.

Mr. Lall

He was the first Indian national to join I.C.I. (India) in the covenanted category, the first to become a director and the first to become a managing director. When **Mr. N. D. Harris,** the present chairman, retires, Mr. Lall will round off his record by becoming the first Indian chairman of I.C.I. (India).

What has brought him to the top? People who know Mr. Lall—and most of them know him as Jaggi rather than as Mr. Lall—pick on four attributes: a very agile brain, which enables him to view things from a "different" angle; his insistence on always getting to the bottom of a problem; his knack of never appearing flurried; and a great flair for making friends.

Born in a part of the Punjab which is now in West Pakistan, Mr. Lall was the son of a Government of India revenue official. His education was frequently disrupted by his father's travels, but eventually he settled long enough in Lahore to obtain a degree in mathematics and economics at the Forman Christian College. (His present skill at cards is said to date from this period!)

In 1933 he came to London to serve his articles as a chartered accountant. He not only qualified, but won the Frederick Whinney prize of the English Institute. He joined I.C.I. (India) in 1939, and from an arduous start as Calcutta regional office accountant he moved to the head office, where he worked under the present chairman.

He shone particularly where taxation problems were concerned, and the excess profits tax, then in its infancy, gave him plenty of scope. In 1948 he broke away from the accounts department and became in rapid succession industries manager, manager in the Calcutta sales office, and then a member of the board.

Mrs. Shuki Lall, whom he married in 1941, is a qualified doctor. The Lalls have two children—a daughter, Aruna, and a son, Vikram.

NEWS IN BRIEF

New Subsidiary. I.C.I. has acquired the whole of the issued share capital of the Colliery Explosives Co. Ltd. of Newton-le-Willows, Lancs. The new subsidiary, which manufactures blasting explosives, will be administered by Nobel Division.

Canteen Prizes. The catering department at Grangemouth Works of Dyestuffs Division and Regent Works of Pharmaceuticals Division won four awards between them at the Scottish Salon Culinaire.

Broadcast from Huddersfield. The B.B.C. radio feature "Gardeners Question Time" will be broadcast on 15th February from the Recreation Club at Huddersfield Works, Dyestuffs Division.

Dowlais' New Restaurant. The Mayor of Merthyr Tydfil, Ald. Mrs. M. McPhail, opened the new works restaurant at Dowlais Factory, Billingham Division.

County Netball Player. Miss Dorothy Tonge of Dyestuffs Division Supply Department has been chosen as goal-shooter for Lancashire County junior netball team.

Nylon Output. Output of polymer from Nylon Works at Billingham last year was 19,300 tons—a record figure.

C.I.L. Debenture Issue. An issue of $20 million worth of debentures by Canadian Industries Ltd. sold out rapidly. $71 million has been raised in new capital since the company was formed in 1954.

S.A. Lightweight. Eric Thompson, who works at the Modderfontein factory of A.E. & C.I., is a contender for the South African lightweight boxing title.

Billingham and the Big Five

SOME fascinating sidelights on Billingham's history are given by **Dr. V. E. Parke** in his book *Billingham—The First Ten Years.*

One of them is the fact that when the Brunner subsidiary Synthetic Ammonia and Nitrates Ltd. bought the site from the government in 1920, neither buyer nor vendor knew that the deposit of anhydrite underneath would be of commercial value. When the plant started up, the anhydrite necessary to the process was brought from Cumberland and Nottingham, and later from West Hartlepool. It was not until 1925 that the Billingham anhydrite seams were proved and shafts were sunk.

Dr. Parke gives vivid pen-portraits of the "Big Five"—the five men who started up the Billingham project and drove it to success in spite of almost incredible difficulties.

The "leader and inspirer" was **Col. G. P. Pollitt,** a chemist and a member of the board of Brunner-Mond. The book is dedicated to him. Col. Pollitt retired in 1945 as a member of the I.C.I. Board and is still living an active life. The other members of the "Big Five" were **H. A. Humphrey,** the consulting engineer; **R. E. Slade,** who was in charge of research; **Capt. A. H. Cowap,** nicknamed "Shack," the chief engineer; and the Secretary **P. C. Dickens.** All of them went on to make names for themselves in I.C.I. after it was formed in 1926, and all except H. A. Humphrey are now leading active lives in retirement.

They have been Warned

A FORGETFUL car driver who was about to enter the main road outside Wilton Works without having switched on his lights one night recently was startled to hear a loud voice saying: "Will you please put your lights on. You are approaching a main road without lights. Switch on, please!"

The advice came from Wilton's new mobile patrol car. Equipped with a loud-hailer, it tours the works roads and draws the attention of people using them to any irregularities.

The patrol car is driven by **Patrolman J. S. Plumpton,** a former North Riding police officer who joined the Company about three months ago. The observer, who operates the radio-telephone and loud-hailer, is **Patrol Foreman A. Baker,** also a former police officer.

In their first three weeks the patrol car men investigated some 60 traffic problems reported to them and others that they found for themselves as the car made its rounds.

Au Pair

PARENTS who want their children to learn a European language often send them to stay with a Continental family on an exchange basis. But some parents are understandably reluctant to send their children to a family of which they know nothing.

Mr. H. Morris, an I.C.I. dyestuffs representative in the Cork area of the Irish Republic, suggests a way round this difficulty. He says that his wife would be much happier about sending their daughter of 10 abroad if it were to an "I.C.I. home."

Any member of the staff of an I.C.I. company on the Continent who is interested in this particular exchange should write to the *Magazine*, when they will be put in touch with Mr. Morris. We should also be glad to hear from I.C.I. people at home and abroad who would like to "exchange" children.

OBITUARY

Mr. Robert J. Hyde

It is with deep regret that we have to announce the death of Mr. R. J. Hyde at Rouen on 20th December 1957. Mr. Hyde, who was 83 years of age, was a member of the board of Fermeture Eclair from its formation in 1924, and was its chairman from 1928 until his retirement in 1953. To Robert Hyde's many friends at Millbank, Witton and Rouen his death is a great loss, but his invaluable work for Fermeture Eclair, whose affairs he so capably guided, will long be remembered.

NEW APPOINTMENTS

Some recent appointments in I.C.I. are:

Dyestuffs Division

Mr. A. J. S. Cartmell. Division Secretary.

Heavy Organic Chemicals Division

Dr. C. Cockram. A director.
Dr. K. W. Gee. Olefine Works Manager.
Mr. F. J. K. Hillebrandt. Assistant Division Accountant.
Mr. M. A. E. Hodgson. Technical Service and Development Manager.
Dr. D. W. Huebner. Technical Department Manager.
Dr. D. G. Jones. Research Manager.
Mr. J. A. Lofthouse. Engineering Manager.
Mr. T. B. Owen. Labour Manager.
Mr. E. P. Street. Sales Control Manager.
Mr. R. T. Wilson. Staff Manager.
Mr. F. Witt. Techno-Commercial Manager.

Nobel Division

Dr. W. C. Cresdee. Division Medical Officer.
Mr. W. B. Ogilvie. Chief Safety Officer, Ardeer.

Paints Division

Mr. C. I. Snow. Research Director.

Pharmaceuticals Division

Mr. T. B. Worrall. Finance Director and Chief Accountant.

Wilton Council

Dr. H. S. Hirst.
Dr. S. W. Saunders.

I.C.I. Chile

Mr. J. Holman. Vice-president.
Mr. J. B. D. Pagden. Managing Director.

TRY-OUT FOR WONDER CHEMICAL (*continued from page* 41)

As yet the picture of the usefulness of gibberellic acid in sugar-cane is not at all clear. There have been reports of some yield increases as a result of treatment with the chemical, but the effect of gibberellic acid on the nature of the sugars and on the general chemical constitution of the extract is not yet known.

There is no doubt that the results with gibberellic acid on celery in Michigan have been most interesting, and there is probably a small commercial outlet for the chemical on this crop. Again growers of crops for seed will probably take advantage of the fact that gibberellic acid can hasten seed production of several annuals and biennials, but these markets are likely to be small.

Pineapples are the subject of research work in Puerto Rico and elsewhere, but techniques of growing pineapples vary in different parts of the world, and it may be that this new discovery may prove more useful in some pineapple-growing countries than in others. Forestry research organisations and paper and pulp producers are anxious to study the effects of gibberellic acid on tree growth; the former to see if they can shorten the period between sowing forest tree seeds in the nurseries and the final planting out of these trees in the forests, and the latter in the hope that gibberellic acid will speed up the growth and development of pulp-producing poplars. Rubber research institutes are also interested in accelerating the growth of young rubber trees, and if gibberellic acid could help to bring these trees into production say one year earlier, it would be exceedingly popular in countries like Malaya, Ceylon and Indonesia.

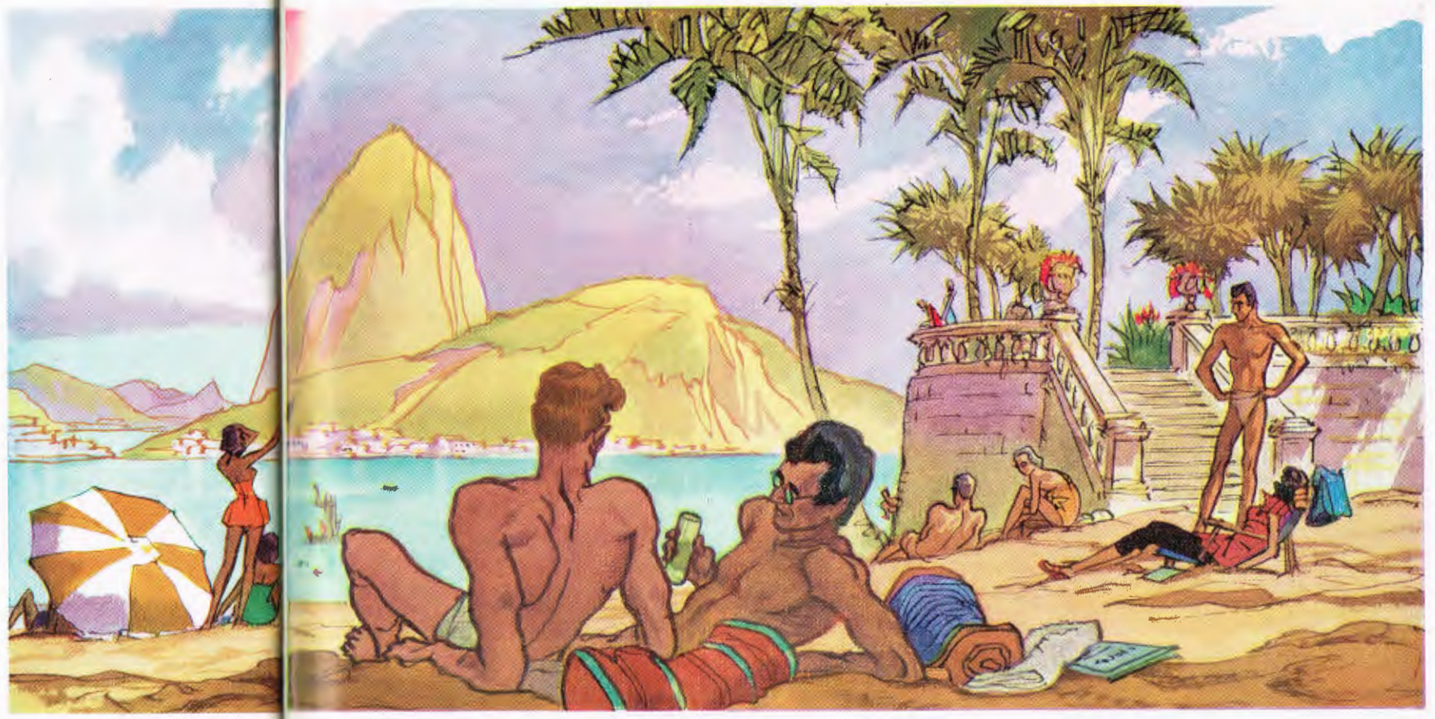
It is obvious from the foregoing that the future of gibberellic acid is still largely speculative, but the coverage of research work is wide enough to ensure that, should the chemical have outstanding commercial possibilities, these will be revealed in the course of the next year or two. It is perhaps unfortunate in some ways that gibberellic acid has received so much commercial publicity, and yet this very publicity has probably been responsible for stimulating applied research.

This article is in the nature of an interim report. Perhaps one day one will be able to add that gibberellic acid is firmly established as an aid to the growth of some of the world's major crops.

Flying Visit

By Derek Marquis

An air trip of 17,500 miles with no stop longer than three weeks is still no everyday affair. And an observant traveller with a retentive memory can still come home with a good story.



"I lay on the golden sands of Copacabana Beach, soaking in the hot sun . . ."

WHEN one day last year I was asked by my superiors if I spoke Spanish, I couldn't help thinking of that famous wartime question: "Can you ride a motor bike?" But this particular question was straightforward enough, and before long I found myself at London Airport at the beginning of a 17,500-mile trip, almost entirely by air, to South America and back.

I was to travel with Mr. W. H. Day, Metals Division Export Manager, who has flown from London Airport so many times that although he doesn't actually own it he is at least regarded as a V.I.P. Maybe that is why we were treated free to a welcome pre-flight palliative and persuaded to sign the Distinguished Passengers' Book within blotting range of Liberace's signature. We then took off for Shannon and a 14½-hour non-stop flight to Idlewild.

The two days spent in New York saw the burial of many misconceptions and prejudices. I learned, for example, that it wasn't compulsory to wear a hat indoors all the time. I became an iced-water drinker, though I never took to coffee with soup. Crossing the street was less hazardous than I had dared hope, and the pace of the crowds on the sidewalks was as leisurely as in many provincial English cities.

Our taxi-driver shook hands with us, and we weighed in for the next stage of our journey, to Jamaica.

After a brief stop at Montego Bay our plane brought us safely to Kingston, where, for lack of space ashore, the runway is built out into the harbour. Following our representations, the I.C.I. office in Kingston has promised to warn prospective airborne travellers to the island that appearances are deceptive, as no plane has yet undershot the concrete and landed in the Caribbean.

Once the engines had stopped, the aircrew rushed away to meet their friends, leaving us, the fare-paying public, to find our own hand luggage in the dark and confined entrance to the cabin.

On stepping out we met the heat for the first time. It was not a scorching heat as I had expected, but more like the embrace of a friendly but perspiring grizzly bear.

The contrast between my bedrooms in New York and in Jamaica was startling. In the one, only the hum of the air conditioner reminded me of civilisation; in the other, the noises crowded in on each other in an exciting jumble. There was the most incessant and urgent barking of distant dogs, the road drill rattle of bullfrogs, and many other creatures I could not even guess at added their threats, boasts and love-making to the thick, sweet nights. "This is Africa!" I murmured ecstatically and untruthfully.

Jamaica was a garden where I could happily have spent a great deal more time, but two days after arriving we were rushing seawards along the runway bound for Caracas, capital of Venezuela. We arrived there on a saint's day (it is difficult not to, I understand), and though our stay there was very short, we were in Caracas just long enough to form some idea of what it must feel like to turn on a tap and watch gold pour out. When the Venezuelans turn taps, oil pours out; but the effect is very similar. Of course, there are many Venezuelans in Caracas who are not "on the mains," so to speak. Their situation is not to be envied.

Next we boarded a humble DC3 for Bogotá, capital of Colombia. We landed for about twenty minutes at Barranquilla (where the temperature was about 100° F.) before going on to Bogotá (where the temperature was about 50° F.). Bogotá is at 8500 ft., and the climate is said to be the same all the year round. It is in many ways a typical South American city set in what appeared from the air—for we had no time for exploration—to be very beautiful surroundings.

A DC4 took us on to Cali, an attractive town southwest of Bogotá. To me this trip was something of an adventure, as it was my first flight in cloud over mountains. A drop in an air pocket lasting some three or four seconds did little to give that confidence so necessary to enjoying air travel. But to the parish priest in the seat across the gangway, the family with the baby in the carry-cot, the overheated man in the green uniform, it was air transport or nothing; and to see two women clambering down the aircraft steps at Cali with laden shopping baskets on their arms made the aircraft seem more like a country bus.

Our next stop was Lima, the ancient and modern capital of Peru, an interesting and in parts beautiful city. The old-style colonial type houses, with their shut-in balconies looking like glass-fronted bookcases, were much in evidence. So, of course, were the "skyscraper" public buildings beloved by the South Americans. One such building was the Ministry of Education, a magnificent and beautiful edifice. "All we need now is some schools," said my guide as we gazed up in admiration at its fourteen floors.

"The inhospitable view of crag and gully, peak and pit from the plane window . . ."

One of Lima's many fine buildings is the airport. We had to be there early one morning to catch "El Interamericano," which arrived at 7.45 a.m. from New York on its way to Buenos Aires. We were to be passengers only as far as Santiago, where we were to stay for about three days. When we arrived there after an uneventful flight from Lima we found the climate mildly autumnal and very stimulating. Santiago seemed particularly European after Lima, where the waiters and bell-hops were mostly Indians. In fact, except for the great wall of the Andes one might have been in almost any continental European city. The earthquake reported to have taken place at 4 a.m. woke neither of us, so deep and innocent was our sleep.

I should be happy to be able to say I was not frightened when we flew through the Andes, but it would not be true. The inhospitable view of crag and gully, peak and pit from the plane window, and the appalling proximity of the mountainsides to our wing-tips I found most alarming. "It's no good taking photos," said my chief; "they'll never believe them back home."

At long, long last, it seemed, the straining engines were throttled back and we were over the top. Down through the gathering darkness we sped over the flat and fertile fields of Argentina to Buenos Aires, where we were received with surprising warmth and friendliness considering our friends had turned out to meet us once before—at 2 a.m. the previous night—due to a misunderstood message.

I stayed three weeks in Argentina, much of the time in the beautiful city of Buenos Aires, where the pillar boxes are the same as in England and where the railway stations are as like English ones as homesick Britons a hundred years ago could make them. Many English names belong to Spanish-speaking local people with open English faces.

In the north I saw the other side of South American life—no skyscrapers, but hovels and shacks; great farms and sugar cane plantations, gaucho boys, cacti, the ubiquitous poncho on male, female and babies' shoulders, and horses—or aircraft—the normal means of transport.

Flying in these inland areas is almost wholly visual and thus dependent on weather. Consequently diversions and hold-ups are frequent. So I returned to B.A. by train, a testing and dusty 22 hours' run.

There are excellent air connections across the River Plate between B.A. and Montevideo, and ex-R.A.F. Sunderlands are employed by Aerlineas Argentinas with a very high safety record. I crossed by steamer and was four hours late because of the high winds.

Winter had set in by then, and bad weather was the rule during most of the week spent in Uruguay. Much as I enjoyed the place, I read with impatience letters from my chief, who had gone on ahead and was basking in the sun in Rio.

The next hop, from Montevideo to São Paulo, was made in a Clipper, in which I was lucky enough to be invited on to the flight deck. This was a most pleasant experience, for although there were five of us packed into a space too small for a large dog, the flight deck is surely the quietest place in the aircraft bar none. The atmosphere is drenched with enormous competence and calm—qualities that the ordinary air traveller feels he needs in abundance.

It was night time, and when the pilot pointed out to me the lights of São Paulo apparently just ahead, I said I had not thought we should be there so soon. I was told that the lights were still 125 miles away. But we were already on the way down, and as our tyres squealed on to the concrete the airport clock ticked on to the due time of arrival.

São Paulo, the industrial centre of Brazil, is a thrilling city. Very beautiful, very modern, its skyscrapers, though not immensely high, make those of New York look almost dowdy by comparison. For the first time in any South American hotel, I think, the glistening gantry of taps, plugs, levers and gadgets in the bathroom all worked, and hot water came from the hot tap and cold from the cold.

The 250 miles or so from São Paulo to Rio were made by car, probably the most dangerous part of the entire tour, judging by the prodigious number of accidents littering both sides of this truly splendid road.

My stay in Rio de Janeiro was, unhappily, short, for the city exceeds all dreams of beautiful places. I lay on the golden sands of Copacabana Beach soaking in the hot sun before leaving for home, watching the many bathers and sun worshippers at play while my Brazilian friend explained it wasn't too hard a winter they were currently enduring. I agreed. Rio was also the last stop in South America except for half an hour at Recife, 1000 miles north of Rio, where the K.L.M. DC6 was refuelled before the crossing to Dakar. After breakfast there we flew on to Lisbon, where I broke the journey, catching the London plane early next morning.

This last trip was the roughest of all until, without warning, we left the storm clouds dramatically behind over Guernsey and returned to an England bathed in sunshine. Reticence prevented me, but I was strongly tempted to send a note to the pilot before landing: "For God's sake don't make a mess of this one!" With a family waiting down below this seemed particularly important.

Water Carrier in the Casbah

Photo by E. B. James (Plant Protection Ltd.)